

LARVAL MORPHOLOGY OF *SYSTEMA BLANDA* MELSHEIMER
(COLEOPTERA: CHRYSOMELIDAE: ALTICINAE)

JONG EUN LEE, STEVEN W. LINGAFELTER, AND ALEXANDER S. KONSTANTINOV

(JEL) Department of Biology, College of Natural Sciences, Andong National University, Andong, Kyungbuk 760-749, South Korea; (SWL, ASK) Systematic Entomology Laboratory, PSI, Agricultural Research Service, U.S. Department of Agriculture, c/o National Museum of Natural History, MRC-168, Washington, D.C. 20560, U.S.A. (email: slingafelter@sel.barc.usda.gov; akonstantinov@sel.barc.usda.gov).

Abstract.—The first detailed morphological description and illustrations are presented for the larva of a species of *Systema* (Coleoptera: Chrysomelidae: Alticinae), *S. blanda* (Melsheimer). Compound microscopic examination of the head, antennae, mouthparts, and legs revealed characters typical of other soil dwelling and root feeding alticine genera.

Key Words: *Systema*, Alticinae, Chrysomelidae, larva, morphology, character, systematic, flea beetle, leaf beetle

The morphology and biology of many alticine larvae, particularly those including forest and agricultural pests have been studied by many workers, although much more is known for Old World taxa. Notable works on Old World taxa include those of Ogloblin and Medvedev (1971), Kimoto and Takizawa (1994) and Steinhausen (1994) who studied many genera of alticine larvae taxonomically, emphasizing characters of the anal plate and chaetotaxy. Other less expansive taxonomic works on alticines include: Reed (1927); Böving and Craighead (1931); Newton (1933); Anderson (1938); Paterson (1943); Dobson (1960); Yano (1963, 1965); Welch (1972); and Lee (1992).

Despite the contributions of these researchers, detailed larval morphology of *Systema* has heretofore remained undescribed. Chittenden (1900) provided minute illustrations of the larval habitus and anal plate of *Systema blanda* (Melsheimer) (this plate also reproduced in Chittenden 1902a) and a brief discussion of diagnostic char-

acters of the anal plate. Drake and Harris (1931) provided a slightly larger lateral habitus illustration of the larva but no discussion of characters important in identification. Peters and Barton (1969) provided a brief description of the larva of *Systema frontalis* Fabricius but did not provide adequate detail to understand unique and shared characters of this and related taxa.

The purpose of this paper is to provide a thorough description of the larva of the pale-striped flea beetle, *Systema blanda* (Melsheimer). This species is widely distributed, ranging from the northeastern United States to California (Chittenden 1902b). Members of this species are encountered on a range of agricultural crops, having been reported on onions (Drake and Harris 1931); beans (Chittenden 1900, 1902a); corn (Chittenden 1900); cotton (Bissell 1941); and sugar-beets (Chittenden 1902b).

METHODS

Detailed morphological description and discussion are provided for the larva *Sys-*

tena blanda. Characters of larval exemplars of *S. blanda* were examined using a Leica MZ-APO stereoscope and Leitz Diaplan compound microscope fitted with transmitted light interference contrast apparatus (ICT). Stereo and compound microscopic illustrations were made using camera lucidas. Images were scanned at 600 dpi using a Nikon Scantouch scanner and enhanced using Adobe Photoshop 3.0 and labelled using Macromedia Freehand 5.5.

DESCRIPTION

Systema blanda (Melsheimer), 1847

(Figs. 1–8)

Mature larva.—Body (Fig. 1) yellowish brown, moderately convex, C-shaped, long and slender. All segments elongate, with numerous scattered setae. Head, spiracles and anal plate brown; mandible, pronotum, and legs pale brown.

Head: Hypognathous, rounded, slightly sclerotized. Epicranial suture rather short, endocarina weakly developed. Frontal suture (Fig. 3) moderately divergent (about 40°) and nearly straight. Frons (Fig. 3) with 5 pairs of frontal setae and 1 pair of frontal sensilla; epistomal suture (Fig. 3) well developed. Antenna (Fig. 2) 2-segmented, segment 1 with a large conical sensory papilla, 4 setae and 2 sensilla, segment 2 short and small, with 1 long seta and 2 short setae. Clypeus (Fig. 4) trapezoidal, with 1 pair of clypeal setae and 1 pair of clypeal sensilla; labrum (Fig. 4) with 2 pairs of labral setae and 1 pair of labral sensilla; epipharynx (Fig. 4) with 6 pairs of epipharyngeal setae. Mandible (Fig. 6) palmate, well sclerotized, with 5 distal teeth, 2 mandibular setae and 1 mandibular sensillum, penicillus well developed with 3 long and straight lobes. Maxilla and labium (Fig. 5): Maxillary palp 3-segmented, segments 2 and 3 each with 1 seta and 1 sensillum, segment 1 without seta; palpifer with 2 setae; stipes with 2 setae; cardo with 1 seta on outer anterior margin. Galea broad, with 6 setae; lacinia with tightly bunched group of

6 setae. Ligula stump-like, separated from prementum, not extending from between labial palpi, with 2 pairs of setae and numerous minute micro-setae. Labial palp 2-segmented. Prementum with 2 pairs of setae and 1 pair of sensilla; postmentum with 3 pairs of setae.

Thorax: Pronotum pale brown, weakly sclerotized, with 12 pairs of setae. Mesothoracic spiracles annuliform, situated on epipleural anterior part; peritreme darker than adjacent cuticle. Legs (Fig. 8) rather stout; tibia with 8 setae (5 stout); tarsungulus falciform, moderately curved anteriorly, enlarged base with 1 seta; pulvillus whitish, bladder-like, as long as tarsungulus.

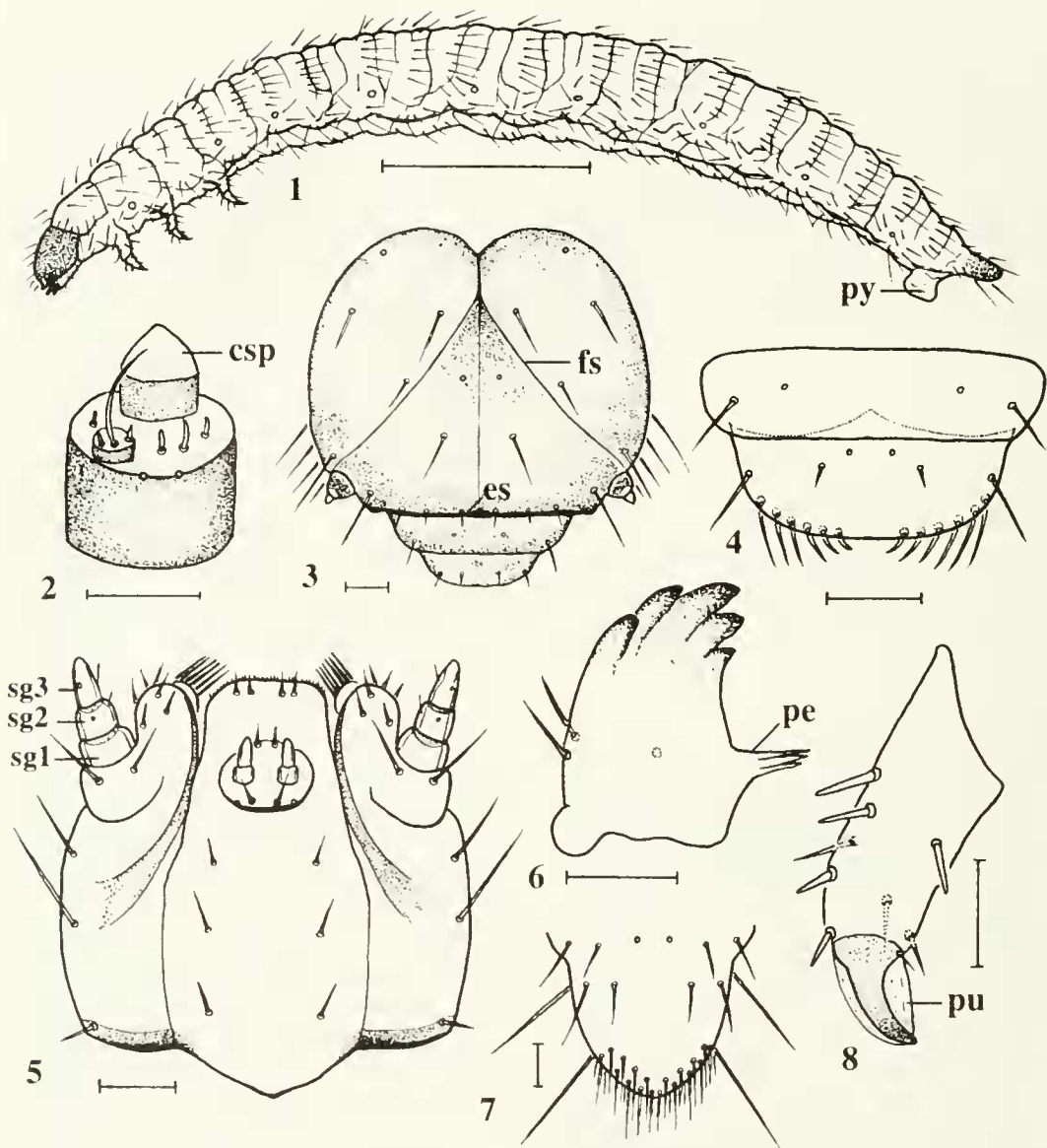
Abdomen: Typical abdominal segments with three folds. Abdomen with 8 pairs of spiracles, the peritremes circular. Epipleuron and pleuron each with 6 setae. Anal plate (Fig. 7) saddle-shaped, with 12 pairs of long setae (including 2 pairs of long setae on lateral margin of ventral side), 1 pair of medial sensillae, and about 20 additional, shorter setae at margin of apex of anal plate. Tenth abdominal segment well developed, straight, with ventrally directed pygopod (Fig. 1).

Body length: average 5.2 mm ($n = 5$).
Head width: average 0.45 mm ($n = 5$).

Material examined.—Bard, California, 5 specimens, V-15-1913, H. Pinkus, collector. Deposited in the National Museum of Natural History, Smithsonian Institution, Washington, DC.

DISCUSSION

Alticine larvae can be categorized into three types based on their ecological association: (1) leaf living including external feeders and leaf miners; (2) stem borers; and (3) root feeders (soil dwelling). The morphology among these types is not always distinctive and convergence clearly exists when distantly related taxa share the same ecological association. Larval characters of external alticine leaf feeders are similar to many genera of galerucine larvae



Figs. 1-8. Larva of *Systena blanda*. 1, Mature larva, lateral view. 2, Antenna, dorsal view. 3, Head, dorsal view. 4, Clypeus, labrum and epipharynx, dorsal view. 5, Lower mouth parts, ventral view. 6, Mandible, buccal view. 7, Anal plate, dorsal view. 8, Left hind leg, dorsal view. Scale line = 1.0 mm (Fig. 1); 0.05 mm (Figs. 2-8). Abbreviations: csp = conical sensory papilla; es = epistomal suture; fs = frontal suture; pe = penicillus; pu = pulvillus; py = pygopod; sg# = segment number.

and are characterized by having a well developed tubercle, body densely covered with setae, and labial palp 2-segmented. Leaf mining and stem boring alticines are similar to hispine larvae and are character-

ized by having a flat body form, hind corners of epicranium largely produced posteriorly, antenna 1-segmented, cardo reduced or fused with stipes, 8th abdominal spiracle well developed, and labial palp 1-segment-

ed and strongly reduced. Some leaf miners and stem borers have 1 pair of terminal spines on the anal plate. Characters of soil dwelling alticine larvae are very similar to those of external leaf feeders but are easily distinguished by their very long and slender body shape.

Systema blanda larvae feed on the underground portions of seedling onions, primarily on the subterranean leaf sheaths and rootlets (Drake and Harris 1931). This same feeding behavior probably applies to the other hosts, but has not been documented. The larvae expectedly have the characteristic appearance of root-feeding alticine larvae. In this respect, they are similar to *Chaetocnema* Stephens, *Epitrix* Foudras, *Hermaeophaga* Foudras, *Longitarsus* Berthold, *Phygasia* Dejean, *Phyllotreta* Chevrolat, *Pseudodera* Baly, and *Psylliodes* Berthold in the long, threadlike body and soil dwelling habits. Two-segmented antennae likely occur in all these genera based on other shared morphology, although the antennal morphology for larvae of *Phygasia*, *Phyllotreta*, *Pseudodera*, and *Psylliodes* is unknown. Diagnostic characters of *Systema* include: segment 2 of antenna with a long seta and 2 short setae (potentially shared with other genera), ligula with numerous setae anteriorly, mandible with long, stiff penicillus, legs with stout setae and anal plate with many setae posteriorly and 2 pairs of long setae on lateral margin of ventral side.

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